NAVAL AIR ENGINEERING CENTER

PHILADELPHIA 12, PA.

IN REPLY REFER TO:

XM-411-WEM:lbg
10330
(1048)

30 September 1963

From: Commanding Officer, Naval Air Engineering Center, Philadelphia 12, Pa.
To: Chief, Bureau of Naval Weapons (RRMA-36)

Subj: PAN 3-24, Evaluation of Hydraulic Fluids - Report No. NAEC AML 1764, Results of Thermal and Hydraulic Stability Tests on Titanium Organic Compound Hydraulic Fluids Developed by New York University

Ref: (a) BUWEPS ltr RRMA-36:TM/2 of 26 Jul 1963
(b) PAN 3-24, Evaluation of Hydraulic Fluids submitted by Industry or Government Contractors

1. The Chief, Bureau of Naval Weapons requested by reference (a), that stability tests be conducted on two experimental hydraulic fluid samples prepared by the New York University under BUWEPS Contract NOw 62-0647-d. These fluids are identified as follows:

Sample A - Reaction Product Modified with Tetrabutylin
Sample B - Reaction Product Modified with Tri-Isopropylborate

2. The fluids were tested in accordance with the methods of paragraphs 4.5.1, (Oxidation-corrosion stability test at 400°F) and 4.5.12 (Hydrolytic stability) of Specification MIL-H-8446B, Hydraulic Fluid, Non-Petroleum Base, Aircraft.

3. The results of the oxidation-corrosion test are as follows:

(a) Corrosion, wt. change (mg/cm^2), max.

Metal	Spec. Limit	Sample A	Sample B
Silver	±0.2	nil	nil
Steel	±0.2	nil	nil
Aluminum	±0.2	nil	nil
Copper	±0.4	-2.41;-1.59	-0.40;-0.30

(b) Appearance of Metals

Metal	Spec. Limit	Sample A	Sample B
Silver	no pitting or etching. No black or gray stain, slight stain on copper.	milky	unchanged
Steel		darkened	darkened
Aluminum		unchanged	unchanged
Copper		dark brown	dark brown

(c) Appearance of Fluids

	Spec. Limit	Sample A	Sample B
Color	no requirement	very dark	slightly darkened, clear
Sediment	no sediment or gumming	semi-solid type	semi-solid type
Vis. change	±35%	+18%	+10%

XM-411-WEM:lbg
10330
(1048)

(d) Neutralization Numbers

	Spec. Limit	Sample A	Sample B
Original	0.2	138	150
After test	+0.5 max.	129*	145*

*Within experimental error for this range.

4. The results of the hydrolytic stability tests are as follows:

(a) Weight changes of copper (mg/cm^2) max.

Spec. Limit	...Sample A	Sample A...	...Sample B	Sample B...
	Before Brushing	After Brushing	Before Brushing	After Brushing
±0.5	-0.28	-0.32	-0.19	-0.26

(b) Appearance of Fluid

	Spec. Limit	Sample A	Sample B
Vis. change of oil layer	±20%	-19%	-7%

Sample A formed a heavy cloudy oil layer and a thick emulsion in the water layer. Sample B formed a slightly cloudy lower oil layer and a clear water layer. Neither sample could be filtered without difficulty.

(c) Neutralization Numbers of the Oil Layers

	Spec. Limit	Sample A	Sample B
Original	0.2	138	150
After test	+0.5	136*	144*

*Within experimental error for this range.

Inasmuch as these materials are not required to meet the requirements of MIL-H-8446A, the specification limits are included for information only.

5. Although neither fluid meets the thermal and hydrolytic stability requirements of MIL-H-8446B entirely, Fluid B, the fluid modified with tri-isopropylborate, is the more stable of the two.

6. The results submitted herein were obtained by work conducted under the reference (b) problem assignment which is being kept open for future work of this nature.

R E Fellowes

R. E. FELLOWES
By direction